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SELECTED TRANSLATIONS ON EAST EUROPEAN MATERIALS INDUSTRIES

No 2

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SELECTED TRANSLATIONS ON EAST EUROPEAN MATERIALS INDUSTRIES

No 2

This is a serial publication containing selected translations on the fuel, electric power, mining, metallurgical, and construction materials industries in Eastern Europe.

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BULGARIA

MECHANIZATION OF CONSTRUCTION EQUIPMENT

/Following is the translation of an unsigned article in Stroitel (The Builder), No 16, 19 April 1961, Sofia, pages 1 and 2./

Small mechanization is one of the main reserves which could contribute to increasing the labor efficiency in construction works. It is well known that the basic processes in the building industry are still performed by hand and have generally a craftman's approach. Many managers of building organizations, building areas, and building projects tend to increase the number of their workers instead of concentrating their attention toward the mechanization of the basic processes which increase labor efficiency many times. By increasing the labor force, these managers attain just the opposite results: they overspend the workers' salary funds, and at the same time, labor efficiency decreases.

Such managers should be openly told that they do not grasp the building objectives as set by the plenum of the Central Committee of the Bulgarian Communist Party, that they show complete ignorance of the new requirements, and that they harm the people's economy and the workers, since they act against the directives of the party and the government.

Loading and the unloading operations in the building process consume the greatest part of the labor, but performed by hand. According to the approximate data referring to the building industry in general, that part of the labor which is consumed in the loading and the unloading operations represents more than 8.4%, and that part which is consumed on the building sites for internal transport is more than 10.5% of the total labor. This represents almost 20% of the total labor of the building industry. The primitive procedures of these projects engages the labor of several ten thousands of workers.

Labor efficiency can be increased four or five times and the number of workers decreased correspondingly if the loading and the unloading operations are mechanized. Derrick cranes, hydraulic platforms, pulleys for lifting the front axis of trucks, simplified swinging platforms, double bottoms tilting on either side of the truck, conveyers, and other items are used. Minimal appropriations are necessary to supply the building sites with mechanical equipment of this kind.

It is evident that the managers of construction organizations, of construction areas, and of building sites do not show any interest toward the problems of increasing the labor efficiency. They do not

care about wasting natural resources, which can be saved and used for the well-being of all of us.

Here we are not concerned only with the carelessness of some managers who do not even try to secure mechanical equipment for their building purposes, but also with those construction organizations which have them but do not utilize them profitably. Our building experience is abundant with examples showing bad management and utilization of the small mechanical equipment which we have.

New machines are even not utilized in large national construction projects like the Kremikovtsi Metallurgical Combineg where two machines procured for the purpose are not used at all. For a long time a brand new welding apparatus was left idle. The loading of gravel, sand, and dirt in many instances (including quarrying) is done by hand; at the same time, through the manager's fault the newly supplied high-production loading bulldozer "Belarus" was dismantled and used as a tractor only. In the same building-site concrete is even now carried around in buckets, while we have been expecting this construction project to become a model enterprise in our construction activity.

Dazzling with examples for poor utilization of small mechanical equipment are the central offices of "Hydrostroy" /Water Projects/, "Minstroy" /Mine Projects/, "Montagi" /Assembly and Mounting Projects/, as well as the local construction organizations. In spite of the fact that there is everywhere an acute shortage of plasterers, the high-production plastering machines procured from abroad which increase labor efficiency three to four times are almost nowhere utilized efficiently. The greatest part of them have been rusting in warehouses or on construction sites for many years. Nobody takes care of them. For instance, in the construction organization of the Russe District only, there are five plastering machines about which nobody shows any interest -- neither the management, nor the social or political organizations.

The bending of concrete steel is done with machines. This process increase the labor efficiency four to five times. However, no steps are taken to buy more bending machines or to make more efficient their utilization. As a consequence, steel-bending is done primitively, by hand at the greater part of building projects and even in the shops for concrete steel of many auxiliary enterprises.

Our building enterprises are equipped with 135 machines for the cold pinching of concrete steel. These machines are supposed to improve concrete steel production, to increase labor efficiency, and to bring about a huge economization of concrete steel. These 135 machines are enough to satisfy all our needs. By order of the construction committee, the factory "Proms" even began to produce spare rollers for them. Unfortunately, the greater number of these machines is also not utilized properly (with the exception of the enterprise "Factory Constructions," where the results are good) and the results are not satisfactory.

Various devices and equipment, small mechanisms, and mechanized tools are used in the building process. They increase labor productivity significantly, make construction cheaper, and alleviate the workers' toil. For instance, the concrete workers using the electric

drill increase the productivity of molds 7 to 8 times. The plaster mixers, the floor sanders and floor polishing machines, the automatic pistols for nailing, the mosaic polishers, borers, the circular saws, the mechanical hammers, and others do the same. Some construction districts do not have enough of them and do not efficiently use what they have. Other construction districts do not have any.

It must be made clear to the administrative and technical management of construction enterprises and construction districts, to the managers of construction projects, to the party's trade union- and Komsomol committees that without an increase of labor efficiency, the problem of accelerating and making cheaper the construction process cannot be solved; that without a fast increase and full application of the small mechanization, the problem of increasing labor efficiency cannot be solved. This is the basis of our daily construction process. Under the leadership of the party and with the help of the trade unions and the Komsomol organizations, a merciless fight must begin against the ossification and the conservatism of some managers, against everybody and everything which slows down and hampers the development of the our construction activity.

BULGARIA

HOW TO DETERMINE THE STAFF OF COMPLEX BUILDING BRIGADES

/Following is the translation of an article by M. Petkov in Stroitel (The Builder), No 16, 19 April 1961, Sofia, page 3./

In connection with the article "The Complex Brigades — An Important Factor for Increasing Labor Productivity and Decreasing Construction Costs," published in No 11, 15 March 1961, the editor received many letters. In these letters the readers want to know which staff of a complex brigade (in numbers and categories) is most suitable and how it should be determined according to characteristic working conditions.

In this connection, the editor asked the author of the article, M. Petkov, Junior Scientific Collaborator at the Research Institute for Labor and Prices to clarify this. Here we published his answer.

A considerable number of complex construction brigades were under observation during 1960. This observation uncovered a fixed interdependence between their staffing and the labor productivity they achieved.

More than 100 brigades were observed. According to the number of their workers and their productivity, they are divided as follows: brigades with up to 10 workers fulfill their predetermined norms 151%; brigades from 10 to 20 workers, 148%; from 20 to 35 workers, 146%; and from 50 workers up, 138%.

These data show that the larger the brigade, the lower is its productivity. This makes it necessary to set certain limits of the maximum numerical staffing of complex brigades.

If we take into consideration our experience of many years and also the results of research and observations, the following is the maximum numerical staffing most suitable for our conditions: up to 15 workers for complex specialized brigades performing one basic work process and all auxiliary work processes connected with it (e.g., bricklaying with preparation of the mortar and with transportation of the materials in the work site); up to 25 workers for complex brigades performing a technological cycle or a phase of the construction project (e.g., performing all work processes during the phase of the rough construction); and up to 35 workers for complex brigades performing work by contract.

The professional and qualification character of the brigade's

staff also influences its labor productivity. The brigades which have a comparatively correct qualification and professional staffing achieve a higher labor productivity, on the average 10% more than the brigades formed incorrectly.

For this reason, the problem of how to determine the numerical, professional, and qualification staff of the complex brigades is very important. The technical leaders of construction projects must solve this problem during the advance preparation of the work of these brigades.

Before we try to determine the staff of a complex brigade according to professions and categories, we must figure out the time necessary for each norm in man-hours of each category and kind of work. Therefore, the time necessary for each norm is divided into the work hours of the work-shift and into the number of days in which the project must be completed. The total of these results for each category represents the staff of each specialized group, and of all groups together -- of the whole brigade.

In order to determine the actual staff of the complex brigade, we must decrease the number of workers, which we received after computing the norms for each category, proportionally to the supposed fulfilment of the norms. The sum of the staffs of the individual groups, received after taking in consideration the supposed fulfillment of the norms, represents the actual staff of the complex brigade; we also assume the possibility that each worker performs several jobs.

For instance, we compute in our contract calculation that we need 3rd-category diggers for 8.06 days and 4th-category diggers for 0.29 days -- a total 8.35 days; concrete workers 4th-category for 3.11; 5th-category for 0.54; and 6th-category for 0.36 days -- a total of 4.04 work days, etc., or for diggers and concrete workers -- a total of 32.26 work days. In this case, if we plan the fulfilment of the digging norms to be 120%, we will need six diggers of the 2nd category and one of the 4th category; if we plan the fulfilment of the concrete work-- norms to be 135%, we will need two concrete workers of the 4th category, one of the 5th category, and so on; or we will need the following total: 12 workers of the 3rd category, three of the 4th, eight of the 5th, and three of the 6th, a total of 26 workers (with 127% average fulfilment of the norms).

Since it is possible that each worker performs several kinds of work, numerically the brigade can consist not of 26 workers, as it is in our example, but of 14 workers divided into two groups served by one engineer. The first group will consist of eight workers and will perform the following jobs: digging, preparation of the concrete, and the internal transportation of the materials. The second group, consisting of six workers, will do the following: preparation of forms, masonry, carpenter's work, roofing.

If we compute the staff of a brigade in the above manner, we contribute to a further increase of labor productivity in the building industry.

10,428

LEAD AND ZINC ORE MINING IN BULGARIA

[Following is an article by Dimiter Derlipansky in Banyaszati Lapok (Mining Bulletin), Vol 94, No 5, Budapest, 1961, pages 301-305.]

The exploitation of lead and zinc ores and the production of their concentrates has added significantly to the economic development of Bulgaria in the last ten years. These ores are the basis of the non ferrous metallurgy of the country.

The most important lead-zinc ore layers are located in the southeast Rhodope Mountains, close to the Greek border. Only insignificant quantities of lead and zinc are found in the western part of Bulgaria (these are in the Sedmochislenic and Osoghovo mines).

In agreement with the 1948 Soviet-Bulgarian treaty, a geological expedition was organized to explore the lead and zinc ores of the Rhodope Mountains. The results of their research surpassed expectations within a few years. Between 1948 and 1956, forty new locations were discovered with the help of Soviet experts and geologists. These locations were explored in detail. The discovery of these ores raised the known Bulgarian lead and zinc deposits thirty times.

To exploit this ore, the GORUBSO Soviet-Bulgarian mixed ore mining company was organized in Rhodope on 1 July 1950. In the next six years the company created approximately 30 new mining towns. The Madan, Rudozem, Batantzi, and other mines have a living area of over 250,000 m^2. Several flotation plants were built, the biggest of which is the Rudozem plant, having a capacity of 5000 tons daily. Rope-ways about 30 km in length and many compressor stations, electrical sub stations, and pumping stations were constructed. Several thousand workers and many machines were employed at the building of these mines, flotation plants, etc.

About 1.8 billion leva were invested in these operations between 1950 and 1960. During this time more than 12.5 million tons of lead-zinc ore were produced; the production was raised from 249,000 tons of ore in 1950 to 2.5 million tons in 1960. The company increased its size tenfold. Production in 1956 alone amounted to the total production between 1941 and 1950. The 2.5 million tons produced annually by the GORUBSO is equivalent to 80% of the total lead-zinc ore production of the country.

Geological and mine-technological data

There are over 50 known lead-zinc ore locations in the southern Rhodope area, 35 of which are under exploitation. The area mined by the GORUBSO can be divided into five sectors: Madan, North Rhodope, Davitkovo, Ustrem, and Madzharovo. [See capiton for figure 1, appended at end of text.]

The ore is found mostly in metamorphic, probably pre-Cambrian rocks. The rocks themselves are mostly biotitous gneisses, pegmatite, amphibiolite, and marble.

The ore is located on the anticlinal northern and southern ranges of the Rhodopes. It is stringly tectonic and has a complex geological structure. The quartz and quartz carbonateous veins of mesothermal lead and zinc sulfides can be seen among the broken, sericitified and quartzified rocks. In the Madan sector alone, six parallel ore zones were discovered. The zones are separated by 1-1.5 km and have lengths of 15 km.

The deposits are of two types: vein and metasomatic. The latter accounts for about 10% of the deposits. Most of the veins come to the surface 800-1,200 m above sea level. Mining is limited presently at the +300 m level, but in the Madzharovo, Ustrem, etc. mines, the ores go down to sea level.

The chief ores are galenite, sphalerite, pyrites and chalcopyrite. Cerussite, anglesite, pyromorphite, bornite, azurite, limonite, etc. are present in the oxidized zones. The ore is fairly compact, and its structure is mostly large-grained with some small grains.

The 0.5 - 6 m thick veins are composed of solid quartz-sulfide material; most of them have a definite salband. The Protodyakonov rock hardness is 12-18.

The metasomatic ores have an average thickness of 6-8 m and contain rich ores 1-25 m thick.

The ore and its siderocks are solid and permanent. The metasomatic ore bodies are mostly colony-like, their listing varies from 0 to 25°, are criss-crossed by veins, and can be found in marble and gneiss.

The ores are located in difficult, mountaineous terrains; where the veins were found near the surface, their mining was done mostly by galleries. The deeper ores were exploited by staple shafts.

There are over 35 vertical pits, 25 of which are main pits and 10 of which are service pits. The pits are bored mostly into hard rock, their profile is 6-22 m^2, rectangular, and wood-buttressed. Some pits produce 250,000 tons yearly.

The opening and other gangways were made mostly in the veins. These cuts are trapezoid and have a profile of 4.8 - 8 m^2. Where the veins were less permanent, the pits were cut into barren rock. The cuts were done mostly in the veins themselves and have a pro-

file of 3.25 - 5.2 m^2.

Quarrying methods

Various methods, such as magazine quarrying, level-sliced filled chief track quarrying, slice quarrying with undercut caving, chamber-pillar quarrying, divided level quarrying, quarrying with free pits (continuous cutting), and combinations of the above were used.

Where the vein is narrow or of medium thickness, magazine quarrying is the best. Sixty percent of the ores are obtained by this method. The other ores are mined by filled quarrying. Where large or dilution threatens, filled quarrying must be done in the place of magazine quarrying.

The filling is produced both underground and on the surface and is carried into the mine by gravity or by using mechanized scrapers or tippers.

Selective quarrying is insured by purlins in narrow veins. Here block-undercut caving and other quarrying methods are used. The output of these veins is low.

At some places, apofizas [?] occur parallel to the larger veins; these make mining difficult. Here insured (or uninsured) filled slice quarrying, undercut caving slice-by-slice, divided level quarrying, etc. are used. The colony and other metasomatic ores are mined by free pits (with continuous cutting), by chamber-pillar quarrying and by a combination of magazine quarrying - divided level quarrying. Metasomatic ores are particularly good in the Boriyeva and Gradishche mines, where the chamber-pillar quarrying, free pit quarrying or the magazine quarrying combined by divided level cuts are used with success.

In April 1960 in the Boriyeva mine, 23.203 tons of rich lead-zinc ore were shot free. This came about by using divided level quarrying, V-shaping of the blasting holes and using a "Schafler" blasting machine.

In every quarry block, 50 m is accepted as the optimum length and height.

Good results were achieved in the Petrovica and Boriyeva mines, where in blocks with maximum thickness of 5 m, gangs of ten men shot free 10-12,000 tons of ore monthly. In June 1960, one gang produced 16,500 t ore in Boriyeva, using magazine quarrying.

Where the veins are rich, magazine quarrying is used above the level gangway in some mines without leaving a purlin behind. An iron-concrete vault is used instead of purlin, or a serial metal or wood safeguard is built; the shot ore is stored on that.

The GORUBSO prefers divided level quarrying with long, large caliber blasting holes. This method saves explosives and other important materials. Table 1 gives the 1948 data on materials used in this mining.

Considering ore dilution, the minimum ore thickness which is still mined is 0.7 m^2. This is given 5 - 5 cm (on each side) barren rock shooting, which means 0.8 m minimum thickness in the quarrying pit. Rich veins less than 0.7 m thick are mixed by the selective quarrying of barren rock. Where the salband is not strong, main-screw or wood safeguarding is used to avoid ore dilution. To improve ore quality, the ore is selected in the quarrying block outside before pouring into the bunkers and in the flotation plants.

In the GORUBSO plants and mines the ores must have over 0.5% lead and 0.7% zinc content. Quality specifications are determined by the State Mineral Wealth Committee.

Important geological research is pursued in the GORUBSO mines with GP-1 and KAM-500 boring machines, with underground and surface borings, etc. The total length of these holes reaches 20,000 m yearly. In addition to this, 30,000 m search cuts are done annually. This research has insured mining for yet a few decades, even if 2.5 million tons per year are mined, as now.

The average lead content of the ore is 3.5%, the average Zn content is 3.2%.

Machines

Modern machines are used in the mines, flotation plants, etc. In the mines compressor stations (with a capacity of 80-200 m^3), electric power plants, pumping stations, central ventilation, etc. are used.

PM-508 and OM-506 manual boring hammers, TP-4 and PT-29 telescopic boring hammers, etc. are used in the mines. The diameter of boring stems is 38-44 mm. Regular or No 6 ammonite and to a lesser extent dynamite are used as explosives. Lighting is done by regular and one-thousandth delayed cap squibs or quick-matches.

From the quarrying blocks the ore is carried with LA-10 and LU-15 type scuffles. The transportation is done on the individual levels in 0.33, 1.2 and 2 m^3 tippers. The tippers are pulled with locomotives or II-Tr-2, CSKD, I-TL-IM, and Siemens electrical locomotives. The ore is stacked by PML-5, Nivka, and other stackers.

Boring work is mechanized almost completely. Mechanization of the transportation is 100%. Mechanization resulted in an average 70-150 meter per month progressive speed. In 1956, 286 m maximum progressed speed was recorded in the Strasimir mine. Pit-deepening speed is 20-30 m per month. 20-25,000 m level gangway and breaking open is done in the mines annually. This is sufficient for preparation to quarry the blocks.

The 0.8 t per shift per worker production in 1950 was raised to 1.7 in 1959 by mechanization. The miners are educated, several hundred miners annually take courses. New workers are taught in industrial schools, where the teaching is done by experienced technical employees.

Ore Enrichment

Flotation is done at Rudozem, Kindzhali, Madan, and other places. The flotation plants have a capacity of about 8,000 tons/day. The 1958 production was about 95,000 tons of lead, 95,000 tons of zinc, 85,000 of pyrite, and 15,000 tons of copper concentrate. Figure 3 shows the Rudozem plant, which is the largest of its kind on the Balkan peninsula. The concentrates are of good quality and are well received both home and abroad. The export of the concentrates occupies a significant place in Bulgarian foreign trade.

Protection of the Workers

Favorable conditions were created for the several thousand workers of the GORUBSO. More than 20 million leva are spent on the protection of the workers annually. Every worker is entitled to 36 days of paid vacation yearly and they get daily meals for 4.20 leva. The workers and their families live close to the mines in healthy and comfortable homes. Movies, restaurants, libraries, and other facilities serve culture and rest in the mining settlements.

In order to keep the dust content of the air under the norm, water-rinsed boring, spraying, and partial ventilation are used in the mines.

Perspective of Ore Mining

Several problems have yet to be solved by the experts of thw GORUBSO. These ar: 1) depth-research; 2) further mechanization and automation of transportation, water-raising ventilation, and flotation; 3) improvement of the boring-blasting operation by the introduction of the domestic high hitting-number boring hammers, etc.

The workers of the GORUBSO plan to raise production to 3 million tons annually in the 1962-65 period.

Figure 1. Rough geological map of the GORUBSO lead and zinc mines in the Rhodope Mountains. 1) Madan locations; 2) North Rhodope; 3) Gabrovo locations; 4) Ustre locations; 5) Zvgezdel-Galenit locations; 6) Madzharovo locations.

Figure 2. The 750,000 ton per year capacity Boriyeva ore mine.

Figure 3. Rudozem flotation plant.

Figure 4. Strasimir mining settlement.

Table 1

Kind of work	Explosive in kg	Aquibs (piece)	English fuse (meters)	Boring stems in kg	Pobe-dite in gs	Wood in m3
Used up per ton or ore	0,424	0.73	1.34	0.032	1.21	0.0130
Used up per m^3 of gangway	2,510	3.83	6.41	0.180	7.54	0.0650

10,101

BULGARIA

THE OPERATION COUNCIL: AN ACTIVE ADVISORY BODY FOR REAL LEADERSHIP IN THE PROCEDURES OF BUILDING AND ASSEMBLING

/Following is the translation of an unsigned article in Stroitel (The Builder), No 20, 23 May 1961, Sofia, pages 1 and 3./

Our experience of many years shows that operation councils are very useful bodies, which collectively discuss the curren objectives of the building and assembling works and make necessary decisions. If these councils are proposefully organized, if they creatively discuss the practical problems, difficulties, and obstacles of the production process, they become an indispensable helper of management in its fight for accelerating work, improving quality, and decreasing the costs of construction and installation projects.

The operation council is an advisory body, with the help of which the management analyzes the fulfillment of the objectives, takes concrete and purposeful decisions concerning future work, makes organizational changes, regroups the labor force and technical equipment, and intensifies the work in this or that project or a part of it, according to needs and changing conditions.

The advisory councils are well-organized in the zinc and lead combine near Plovdiv. There, the management skilfully prepares for them, clarifies the objectives in advance, quickly grasps any situation, and therefore has great success in the fulfillment of work schedules.

Unfortunately, the operation councils still do not fulfill these requirements everywhere. Due to inability of the management, they often become a place for endless and sometimes pointless arguments between builders, assemblers, investors, and designers. Instead of working on the current problems in the fulfillment of the plan and work schedules, the management gets involved in long discussions of basic problems; they discuss not the questions connected with the fulfillment of the plans, but the plans themselves and work schedules, about which the technical and the administrative leadership have already taken the necessary decisions.

During meetings of the operation councils, management very often speaks only about difficulties and obstacles; they do not see their own weaknesses and mistakes and divert the attention of the council from its main purpose: to look for and find a way out of a difficult situation.

Typical example of poor utilization of the operation councils exist in the Kremikovtsi Metallurgical Combine. The management of the building and assembling sections are continually in session. They call

the project managers to meetings, taking them away from their work because of unimportant problems which can be solved best on the construction site.

This state of affairs is still going on in this largest project of ours. The workers of many work sites stay idle for hours and days because of a lack of inert materials and concrete; in the meantime, the May plan falls through. The management is still in session, philosophizing about basic questions, instead of taking immediate steps to solve the most important problem of the moment: the shortage of concrete, which paralyzes all other workers.

The same wrong approach and methods exist in many of the projects of the directorates "Hidrostroy" /Water Projects/, "Minstroy" /Mine Projects/, "Montai" /Assembly Work/, and also in the district construction departments. The managers get together in meetings of the "operation councils." In these meetings, which usually last for hours, they discuss problems which have been already solved, about which no discussion is necessary -- only action. They do this instead of deciding in ten or twenty minutes how to distribute the work force and equipment, how to eliminate the waste of time, and how to accelerate the delivery of materials in order to fulfill the work schedule in time. These meetings are sometimes called incidentally, without any advance preparation. Representatives of higher institutions are invited to them, and as a result the operation councils replace the technical and the administrative councils. Under no circumstances should this happen.

Examples of improper manipulation of the operation councils can be pointed out in the cellulose and paper combine in Bukyovtsi, county of Vratsa, in the oil refinery near Burgas, ATZ-Stara Zagora, and many other construction sites. The management must utilize the operation councils to attain a correct and purposeful distribution of the work force, equipment, and materials, according to circumstances. They must utilize them as a tool for familiarization with the project, as an instrument for decreasing the costs of any part of it, instead of making them a place for long and fruitless conferences or turning them into rostra for mutual accusations and unscrupulous arguments while trying to cover their own weaknesses and mistakes. It is also necessary to differentiate between the operation councils of the project itself and the operation councils in which the investors and the designers take part. The latter should not be called together in intervals smaller than 15 days. Special attention must be paid to the advance preparations for these conferences. The management must appear there with a clear stand and proposal. The minutes of the previous meeting must be regularly read, the completed objectives reported, and responsibility for any failure sought. Everyone should concentrate his attention towardsurmounting personal mistakes.

BLACK TEMPER MOULDINGS IN HUNGARY

[Following is the translation of an article by Robert Lamm in Kohaszat-Ontode (Metallurgy-Foundry), Vol 94, No 5, Budapest, 1961, pages 105-110.]

The Csepel Auto Factory started experimenting with black temper moulding in 1958. The first experimental pourings of the '350 steering wheel housing were done early in 1958 in the Ferrous Metal Research Institute. The rolling, metallographic and other analytical tests of the mouldings gave encouraging results. After that, several meltings were carried out in the 500-kg. Heroult-type electrical furnace of the Gyor Foundry and Hammering Factory [Gyori Ontode es Kovacsologyar]. These mouldings had varying Si and C contents and were rolled in the 1-ton experimental electrical furnace of the Pesterzsebet Engine Casting Factory [Motorontvenygyar]. Further experiments were started in January, 1959 in the Sopreon Iron Foundry. By March 1959 the problem of large-scale production of black temper moulding was solved. It is, however, very difficult to keep the Si and C content low. The Sopron factory did not have satisfactory coke in the beginning and we were forced to experiment with calcium carbide addition.

With carbide addition, liquid iron having a low S content as well as black temper moulding made of it can be manufactured, even with poor quality coke.

Carbide can be added to the mixture in several ways, but it is best to mix it into the coke. If possible, low-melting point ($1650 \pm 50C^{o}$) carbide should be used. The regular carbide (which melts at 1850^{o}) is not so effective. The carbide affects the process as follows.

1. By adding 2% carbide, a 3-4% saving on coke can be achieved.
2. The temperature of the liquid iron is raised by $40^{o}C$, even though less coke is used.
3. The C content of the molten iron is higher because the carbon-dissolving capacity of the iron is higher at higher temperatures.
4. Since less coke is used, the S content of the iron is lower. Every per cent coke decrease is equivalent to 0.01 per cent S content decrease in the iron.

Although the carbide has only 5000 Kcal/kg (as compared to the 7000 Kcal/kg of the coke) satisfactory results are obtained when the added carbide is only 50% of the coke saved. This seeming contrdiction is explained by Fig. 9. The temperature of the smelting furnace with the regular amount of coke is shown by the dotted line. A temperature maximum develops and the molten iron drips through this. In this section the iron is overheated. When carbide is added, the path of the dripping iron is shorter but the iron goes through a much hotter zone, which is good for overheating (line 2.).

In the Sopron experiments the S content was decreased to 0.14-0.17% by the addition of the carbide. Later the Sopron foundry received Czech

coke which has a lower S content.

We also had to find the appropriate moulding technology. At first old steel-moulding dies were used. We soon found that new dies have to be made for black temper mouldings, using a special technique. A practical example is the '350 steering wheel housing (Fig. 10.) which required only 1.1 kg overpouring instead of 4.0 kg, which was necessary in case of steel. Considering that the net weight of the piece is 6 kg, this is a very good method.

Every piece made out of black temper weighs less than its counterpart made of steel. This comes about by having thinner and more uniform wall thicknesses and also by the pouring of the larger borings (Figs. 11-13.).

Softening had to be done with special care. Sopron has only 5-ton mine furnaces. Five tons of black temper mouldings at one time was too much in the earlier stage of the experiments. Hence we softened only ca. 1200 kg in two pots at first. Later we raised it to four pots and only after many experiements did we fill all the 12 pots with black temper mouldings. The slow, 3 C°/hour, cooling also created difficulties but we showed that it is possible to make good quality black temper in old type chamber furnaces. The quality is uniform now; the tensile strength surpasses the 35 kg/mm^2 minimum with 8-10% stretching.

Great advantages can be gained by the domestic manufacture of black temper mouldings. The use of ca. 100 tons of moulding decreased the cost of the products by 1.382.239 forints (Table 5). This is attributed to the nearly 10% weight reduction. The domestic suppliers of black temper moulding today are the Sopron "Elzett" Foundry and the Mosonmagyarovar "Mezogep" Foundry.

Illustration Captions

Fig. 9. Temperature curve of smelting furnace. Left of the figure: "Height above the blow-in point". Inside the figure: 1. Coke, 2. Carbide.

Fig. 10. Csepel '350 steering wheel housing. Inside the figure: Left "steel"; right "black temper moulding".

Fig. 11. '30 motor suspender. Inside the figure: Left "black temper moulding"; right "forged steel".

Fig. 12. Csepel '500 steering wheel housing cover. Inside the figure: Left "black temper moulding"; right "steel".

Fig. 13. Csepel '500 steering wheel housing. Inside the figure: Left "black temper moulding"; right "steel".